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MERCED FALLS LOW HEAD HYDROELECTRIC PLANT

BY A. S. KALENBORN.

The San Joaquin Light & Power Corporation has recently completed a low head hydroelectric plant at Merced Falls. The unusual feature of the plant as regards Pacific Coast practice is the low head and the use of an open flume type turbine.

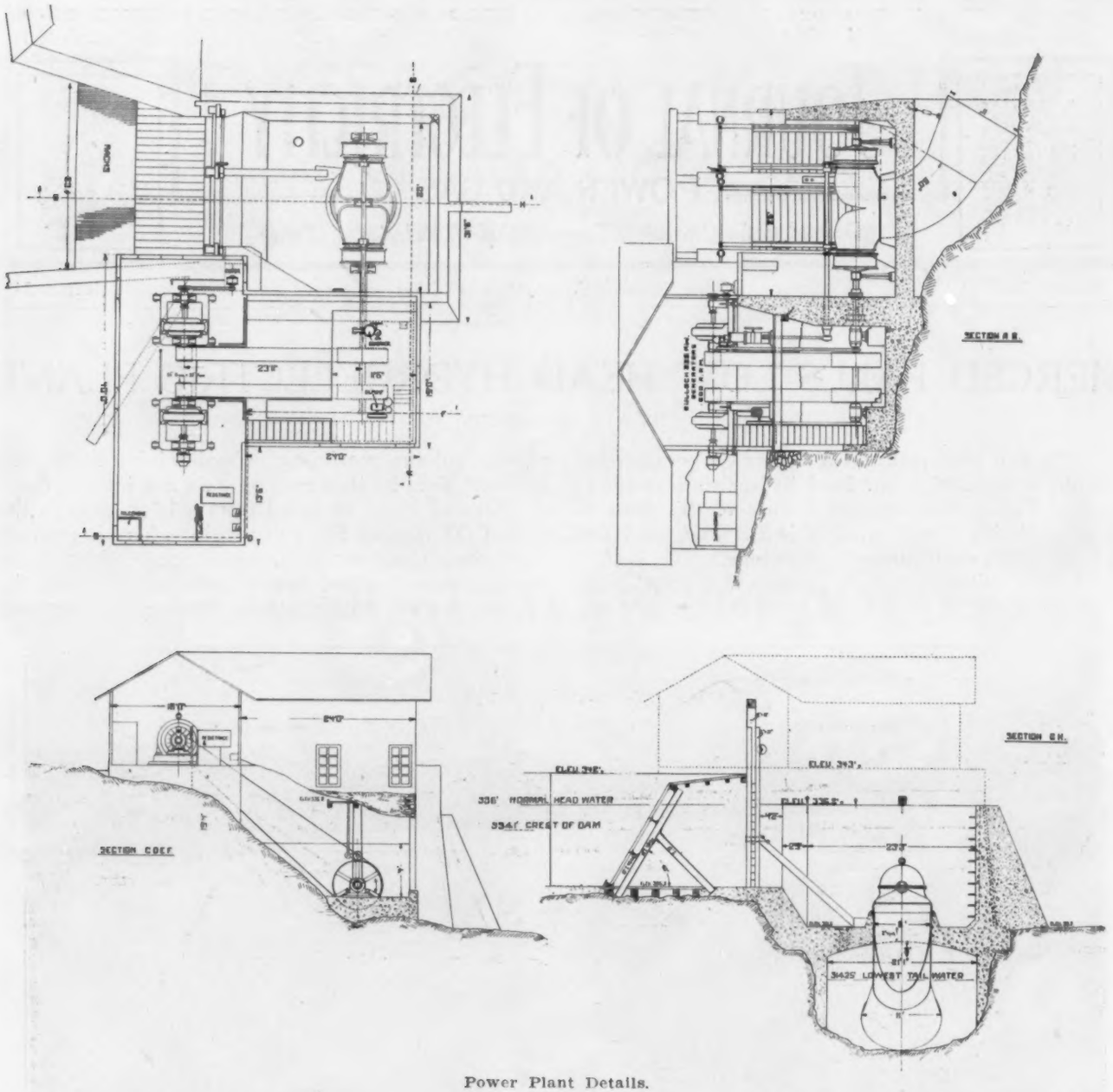
In the utilization of the power of a large, sluggish stream, such as one finds east of the Rocky Mountains, the formula for power $P = QH$ should be written $P = Qh$, whereas, out on this western edge of the continent, where small, torrential streams with heads up to 2000 ft. are put to work, we should more properly write the formula $P = qH$. The foregoing will explain why the writer has prepared this description.

Merced Falls Dam, With Flood Passing Over It.

The San Joaquin Light & Power Corporation operates steam and hydroelectric plants, supplying power to a network of transmission and distribution lines covering almost the entire San Joaquin Valley. Five hydroelectric plants feed into the system, the most northerly one being that at Merced Falls. Because of its location at the end of a long 30,000 volt line, feeding the Merced and Madera districts, even a small plant, like the one about to be described, becomes important when one considers its value as a voltage regulator, and the possibility of maintaining service on the local lines by it in case of main line interruptions.

Merced Falls, so called from a 12 ft. drop in the bed of the Merced River at a point where it emerges from the rugged mountains into the foothills, is in Merced county, about twenty miles northeast of the city of Merced, quite near the boundary line between Merced and Mariposa counties. The river rises in the Sierras, near Mount Lyell, in the Yosemite National Park, flows southwest about 100 miles, and later empties into the San Joaquin River north of the city of Merced. It is the same water which, tumbling down the perpendicular walls of the Yosemite Valley in the many beautiful waterfalls, delights the eye of the tourist, that is put to the commonplace work of generating electricity in the plant at Merced Falls.

Power sites within the broad valley of the San Joaquin are scarce, so we find that as early as 1854 advantage was taken of this mill site by Wm. Nelson and Son, who built a grist mill there. A low timber-crib dam was built to create a storage pond and to increase the head, and a primitive water wheel was used to turn the millstones that ground the wheat.



Power Plant Details.

In 1868 Wm. Nelson and Son, with a few small stockholders, built a woolen mill adjoining the flour mill. On the 4th day of April, 1872, the woolen mill and flour mill both were destroyed by fire. In the same year the woolen mill was rebuilt. The old timber dam was also replaced by another of the same type. On September 23, 1893, the woolen mill was again destroyed by fire, but this time it was not rebuilt. The country about Merced Falls was at this time largely devoted to sheep raising.

A year later, 1894, the power was applied to the generation of electricity, when the Mt. Gaines Mining Company installed a vertical turbine to drive a 135 kw. belted Stanley generator. Power was transmitted a distance of fourteen miles to the east at 10,000 volts, to the Mt. Gaines mine.

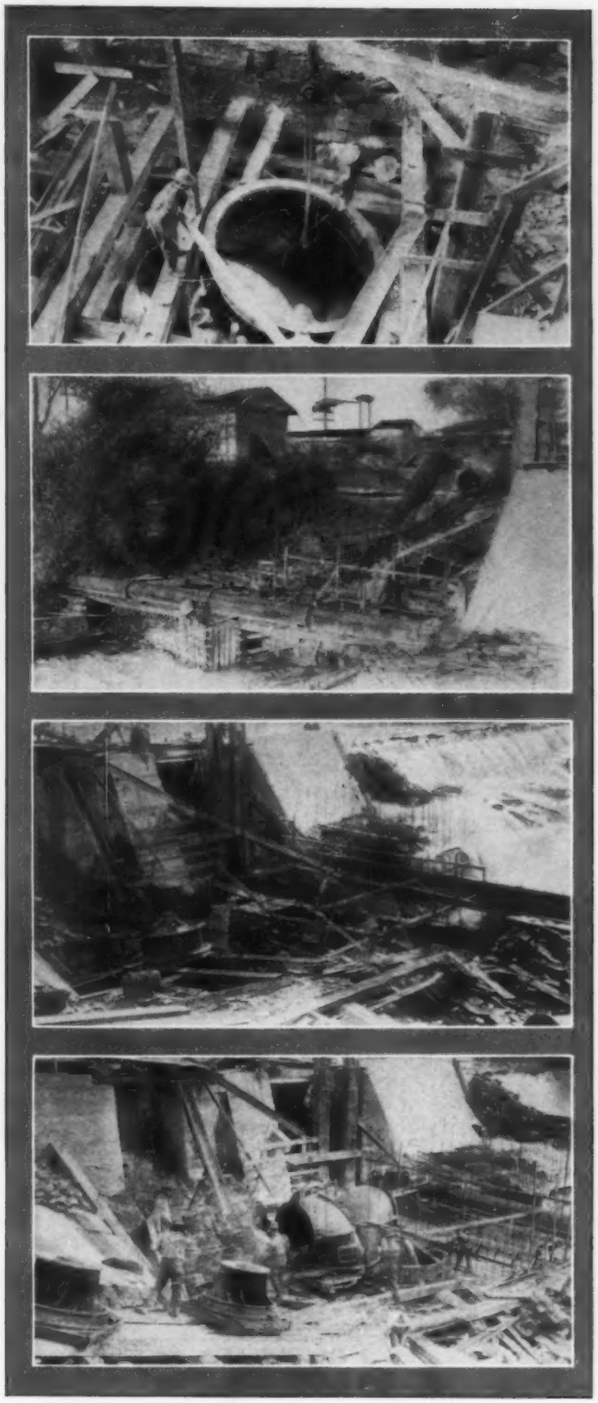
In 1896 the Merced Falls Gas & Electric Company installed two 75 kw. Brush alternators, and two vertical turbines in a pit adjoining the Mt. Gaines wheel, and transmitted the power to Merced at 10,000 volts. These plants operated independently until 1900, when the entire installation was taken over by the Merced Falls Gas & Electric Company.

In 1901 the old wooden dam was replaced by the present permanent concrete dam, which is more than 500 ft. long and about twenty feet high.

In 1903 the Brush machines were replaced by a Bullock 225 kw. generator, and in 1910 a new transmission line was built, of No. 2 copper on forty foot poles, insulated for 30,000 volts.

In January, 1911, at the time of the "big flood," the water flowing around the end of the dam undermined the power house foundations, which had not been carried down to bedrock, and wrecked the plant. The electrical machinery was salvaged, but the power house site has stood idle since that time, although the lake above the dam has been used as a mill pond by the Yosemite Lumber Company, which operates a large modern sawmill and box factory **there.**

Condition Before Starting Work: (1) Old Foundations of Former Power House; (2) Excavation and Remnants of Old Tailrace; (3) Concrete Conveying Runway on Dam Crest; (4) Tailrace Before Excavating Island and Slate Point.



Progress of Construction. (1) Lowering 60 Degree Draft Tube Elbow Into Position; (2) View From Dam, Showing Reinforcing Steel of Turbine Chamber and Draft Chest; (3) View From North Bank; (4) Moving Draft Chest and Runners Into Turbine Chamber.

The pond has an area of approximately 40 acres, and there is a possibility of varying the level through a daily range of three feet, so that at low water stages this 120 acre feet of pondage is available for operation over the "peak." There is no storage in the water shed above Merced Falls, the natural flow of the river varying between a maximum of 40,000 c.f.s. and a few hundred c.f.s. at low stages.

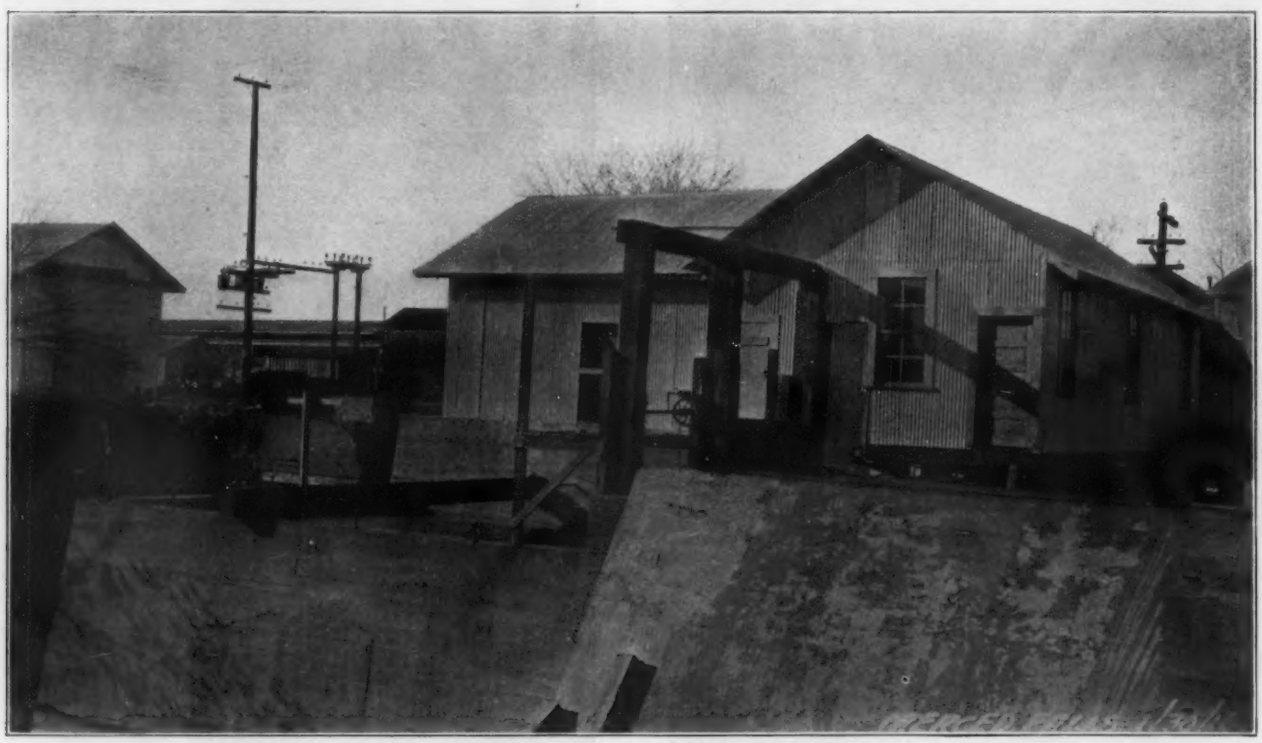
In the summer of 1915, it was decided to rebuild the plant on a permanent basis, utilizing concrete on bedrock, and work on the plant was accordingly started the end of September, at the time of low water.

Referring to the drawing it will be noted that at the north end of the dam, a 20 ft. section next the shore end has been omitted, the opening thus created being closed by two wooden vertical lift gates. A grating of ¼ in. by 1¾ in. by 16 ft. iron bars, spaced 1½ in. on centers, placed in front of the gates, prevents any large particles of wood or bark from entering the wheel chamber.

The turbine chamber is a reinforced concrete box with open top and side, roughly a 25 ft. cube. The chamber or flume is so placed that the wooden gates close the open side. The arched floor spans a raceway 21 ft. wide, and the water is discharged from the wheel

into this raceway through a circular 8 ft. diameter curved draft tube flared to 11 ft. at the outlet.

The wheel or turbine is simply "drowned" or submerged in this chamber, the governor and main drive shaft, both horizontal, passing through stuffing boxes in the northerly wall. Inspection or repair of the turbine necessitates draining the chamber. The installation is simple, and is evident from the drawing.



View of Power House From Dam.

The turbine is of the twin horizontal, central discharge type, with a pair of 36 in. diameter, type "R" runners, made by S. Morgan Smith Company, designed for an output of 750 h.p., at 20 ft. head, 186 r.p.m. The shaft is 39 ft. 9 in. long, 7 in. to 8¾ in. in diameter, coupled just inside the flume wall for convenience of installation and overhauling, and runs on three lignum vitae bearings in the wheel casing, and in two large babbitted ring-oiling bearings in the pulley pit. One of these bearings is an adjustable thrust bearing to hold the runners in axial position. There are two driving pulleys 82 in. in diameter with 25 in. face, from which inclined leather belts drive the two generators. The efficiency of the wheel between 0.8 and 0.92 gate opening exceeds 82.5 per cent, with a maximum at 0.86 of 83.5 per cent.

The output of the wheel is controlled by wicket gates, 12 radially placed wickets or vanes, closed and opened by the governor, (working similarly to a hot air register), arranged in an annular ring about each runner. The runners and draft chest are plainly shown in the drawing. A Woodward, 10,000 ft., pound oil pressure, vertical type, governor is installed just above the main driving pulleys.

The electrical end presents no novel features, two Bullock, 225 kw., 2300 volt, 3 phase, 2300 volt, 600 r.p.m. revolving field generators being belted to the water wheel, and delivering their output to three General Electric, 150 kw., single phase, 2300/11000 volt transformers in the substation, about 150 ft. distant from the power plant. The 11,000 volt power is either absorbed by the local distributing lines to the mines, gold dredgers and rock crushers in the district, or is stepped up by the 11,000/30,000 volt substation transformers for utilization in the Merced district.

The plant has been operating satisfactorily since power was first put on the line, the generators dividing the load equally without any special arrangements. The governor holds the speed so closely that synchronizing is effected very easily. The plant was built by the San Joaquin Light & Power Corporation's own engineering department, under the supervision of the writer.

Water power for paper making promises to be an important industry in the West, where most of the woods used in paper pulp are obtainable. The Forest Service laboratories at Wausau and Madison, Wis., have recently found eleven new woods that give promise of being suitable for the production of news print paper, while a number of others will produce manila paper and boxboards. Most of these woods are confined to the West, while the groundwood industry now obtains the bulk of its raw material from the East. It is thought that pulp-making plants must eventually move to points where they can obtain a plentiful supply of wood and an abundance of cheap waterpower, two prime requisites in the business. Since the National Forests contain immense quantities of the suitable woods and abundant opportunities for power development, they will undoubtedly play an important part, it is said, in the future of the wood pulp industry. White and red fir are the most promising species in the national forests in California, although lodge-pole and western yellow pine and Douglas fir may sometimes be used.

EFFICIENCY IN INDUSTRY.

BY O. B. COLDWELL.

(This suggestive paper was read before the Oregon State Conference of Social Agencies, held at Reed College, Portland, May 12, 1916. The author is general superintendent of the Portland Railway, Light & Power Company.—The Editor.)

Organized industry, according to the common conception of the term, brings to mind a plan for the accomplishment of work along preconceived lines which have efficiency of production as their object. In any branch of industry it is necessary to have a definite working organization or plan of operation which requires the employment of labor and the use of materials. Whether an industrial plant is operated efficiently or inefficiently depends to a large extent upon the thoroughness and suitability of the planning scheme.

The line between efficiency and inefficiency is not sharply drawn and the terms are relative only. The engineering definition of efficiency is the ratio of output to input in connection with any piece of apparatus or operation measured in like units. It is difficult to apply this definition to industrial operations because the input represents in most cases the employment of a great number of different kinds of labor and the use of many different kinds of materials. In many cases the output is also of varied character and so we do not always find a suitable unit for the comparison of input and output. We might, however, determine the value of the output in dollars and divide it by the value of the labor and material employed, in which case the amount over 100 per cent would represent the degree of profitableness of the industry under investigation.

The greatest increases in industrial efficiency have been attained by the application of mechanical power to supplement or supplant human or animal power. The mechanical advantage brought about by the use of machinery has expanded the usefulness of the human unit many fold.

"Power is the basis of our material progress," says Franklin K. Lane, Secretary of the Interior, in a recent article on "The Industrial Future of the Nation." The productive abilities of our 100,000,000 people are increased by the use of probably 125,000,000 h.p. of mechanical energy, not including animal power furnished by 130,000,000 horses and mules.

"Most of the mechanical energy is used in the form of electrical current. When applied to industrial uses, one electrical horsepower does the work of ten men without tiring. That is, one electrical horsepower does as much work as thirty men working in eight-hour shifts.

"Conservation of human labor goes hand in hand with utilization of mechanical energy.

"We now use about 6,000,000 h.p. of water doing the work equivalent of 180,000,000 men, but we are wasting because we are not utilizing it ten times as much."

The water power illustration serves well to show the possibilities of rendering our industries more efficient by the application of mechanical power derived from water.

Now, what of the inefficiency of the human unit? Before machines can be applied to the work they are accomplishing along all lines of industry, it is necessary for someone to devise and plan the machines themselves and to do so means that the whole scheme of operation must be studied out and understood and the machines made to fit the conditions.

Now, can we not draw a parallel in the case of our human machine? If it is to properly perform the work it has to do, its work should be likewise planned. Of recent years we have heard much about so-called Scientific Management, and what is scientific management? Some seem to imagine it is a something that may be prepared and applied as by means of a brush, or that someone can be found who possesses the idea and can bring it in and leave it. Not at all. Scientific management involves the intelligent understanding of the work in hand, the proper planning of the various operations in a logical order and the coordination of all elements of the organization in the performance of the task.

There must be in an organization an acceptance of this idea if efficient methods are to prevail. The individual must subordinate himself to a general scheme. Not that it is necessary to do away with all initiative of the individual, but it must manifest itself in a different way.

Just as the characteristic curves of an electric motor may be produced by one able to analyze its workings, so may the characteristic curves of human endeavor be secured.

The study of human efficiency has been taken up in a systematic manner. Time studies and motion studies, both of machines and of human operators, are made with the idea in mind of obtaining a definite and exact knowledge of their workings and of eliminating wasted motions and time. This is an educational work.

When the characteristic curves of two men performing an identical task are compared, it will be found that in order to produce the same unit of product, one uses 30 per cent more motions and takes a correspondingly longer time. It is essential if the slower one is speeded up to the standard of the faster that his work be planned differently and he must learn a new way. If this is accomplished, it will be because he is willing to accept a plan of work somewhat different from that which he has previously followed. In other words, increased efficiency must be the result of willing cooperation. The personal make-up, therefore, is of prime importance in determining the ability to secure greater efficiency.

As the application of labor-saving devices and machines increases and efficient methods of doing work are initiated, the problem in industrial management becomes more and more the problem of securing high-grade employes. The work formerly done by manual labor is to a large extent being done by machinery under expert supervision.

However, in the working out of industrial organizations, it has been found that the efficiency grade of employes varies greatly with the kind of labor or work upon which they are engaged. The centralization of operations has also to a large extent brought about specialization in employment, and while an employe may be grossly inefficient in one kind of specialized work, he may prove to be an excellent workman when attempting to perform some task for

which he is better fitted by training, by natural inclination or adeptness. In the Century Magazine Mr. Will Irwin states the following:

"The engineers practicing scientific management have lately taken hold of the printing business, and are in process of reducing its operations to law. They found in one of the clerical positions handling balances a man who had no bent for figures. He was, however, a 'reading man'; he had a passionate love for books. When they discovered this, they put him into the proof-room, gave him special night instruction, and made him a master of that craft. The present manager of another shop was a shipping clerk. Only fairly efficient in a position requiring merely accuracy and a little deftness, he seemed to have a mind for large complexities and a 'way' with men. He was tried in the management, and he went up steadily. The present superintendent of a large cotton mill entered its employ less than four years ago also as a shipping clerk. He had had no previous experience in the industry."

Many large industrial organizations maintain employment bureaus in order to insure a high standard in their employes and a great deal of study is given to the subject of the assignment of the employes to the line of work for which they show themselves to be best fitted.

Another subject to which much attention has been given lately is that of the development and training of employes for better positions. Industrial managements find that by increasing the individual efficiency of their employes through educational training and encouragement that the production efficiency of their plant is increased.

The habits and characteristics of the employes are studied in great detail, in fact, more in detail than the employes study themselves, so that they may be employed at work where their useful production, or effectiveness, or efficiency may be a maximum. Self-analysis is encouraged for the same reason. Men are tried at various kinds of work in order that their "characteristic curves" may be obtained. Training schools are established, lectures are given and educational meetings held, all with the idea of developing the employe, of giving him greater knowledge of the business in which he is engaged and of the requirements in order that he can be of greater service and be more efficient.

In the foregoing an attempt has been made to point out that the very essence of efficiency in industrial management consists of the application of carefully devised plans to the performance of every operation by itself, of the combination of the individual operations into a well-balanced whole, and further, that there is embraced a detailed knowledge of all of the parts of the business, including study of the human as well as of the inanimate elements.

There are also to be considered in connection with efficiency in industry certain elements which are more or less external to the direct operations themselves and which do not always come under the direct control of the management.

Industry requires capital. Large industries, where the principles of efficiency can be more thoroughly applied, require that investments of capital must be made by those who have it to invest and their willingness to invest is dependent upon the probability of the investment becoming a profitable one. Especially is this true of the large public utility industries such as railroads, street railways, gas, water, telephone and light and power systems. These industries are continually striving to apply the principles of efficiency to their internal organizations and operations with the object of rendering better public service and of earning a return upon the capital already invested. In order to encourage such industries and to obtain additional capital to carry out plans for extension, it is necessary that they be allowed a reasonable profit on the present investment over and above the expenses incident to the operation of the plants.

A new community such as this which is burdened with a lot of new and untried laws seeking to hamper and restrict business, will not find it an easy task to induce additional capital to come in and invest. To apply regulation in such a degree as to destroy the confidence of investors is a great mistake and it should be the aim of such organizations as this to work in the interest of such laws as will tend to establish confidence on the part of the investing public in order that we may have in this community the influx of capital which is so much needed to promote additional industries.

ELECTRICAL INSTALLATION ON INSPECTED VESSELS.

The Board of Supervising Inspectors of the United States Steamboat-Inspection Service has adopted specifications for electrical installation contracted for after June 30, 1916, on all vessels coming under the jurisdiction of the service which use electricity for lighting. The specifications have been approved by the Secretary of Commerce. The rule reads:

On all vessels contracted for after June 30, 1916, using electricity for lighting, the installation shall be in keeping with the best modern practices. Wires shall be run in approved iron conduits, armored casing, or molding. Iron conduit or armored casing shall be required in bunkers, cargo spaces, storerooms, etc., and in all places where the leads are liable to mechanical injury. Joints in wiring shall be avoided as far as possible in the above-named spaces. Where wires are led through beams, frames, or nonwater-tight bulkheads, they shall be carried either in iron conduits, armored casing, or protected by hard rubber, or other equivalent bushings. Where wires are carried through watertight decks or bulkheads, they shall be provided with a suitable stuffing box at deck or bulkheads. Where such points are liable to mechanical injury, they shall be protected by suitable boxes or cages.

In locating the wiring system as a whole, care should be taken to provide accessibility for examination and repair. Special care shall be taken to avoid any arrangement which might permit the lodgment of standing water.

All taps, joints, and splices shall be fitted with water-tight junction boxes.

Joints shall be so spliced or the parts so joined as to be both mechanically and electrically secure without solder. They shall then be soldered and properly insulated and further protected by waterproof tape.

REPORT N. E. L. A. ELECTRIC RANGE COMMITTEE.

Merchandising Problems and Co-operation With Manufacturers.

(Continued.)

There are two classes of manufacturers to whom the industry may look for the most practical developments in the electric range.

First, manufacturers who have, in the past, been successful in the making and merchandising of electric household appliances for which a large demand has been created during the past few years.

Second, manufacturers of gas ranges who have already developed the most desirable and advanced types and designs in ranges, and who could readily equip for electric purposes the best numbers of gas ranges, for which there is a popular demand. Such adaptation would, as a matter of course, tend to keep down the usual high development expense pertaining to the designing and placing upon the market of any new line of products.

During the course of our correspondence with the different manufacturers there developed some discussion as to the advisability of the manufacturers forming an Electric Range Manufacturers' Association to consist of representatives of the leading electric range manufacturers of the country. The suggestion in this matter originally emanated from one of the manufacturers, and the sub-committee handling the intercourse with manufacturers was naturally much interested in the suggestion of forming such an association.

The sub-committee fully realizes that there are some matters in connection with the standardization, development, advertising and handling of the electric range concerning which it would seem as if it would be absolutely necessary for the manufacturers to consult with each other. It is recognized that the central stations as well as the manufacturers are intensely interested in the future of the electric range, and the sub-committee is of the opinion that co-operation among the manufacturers, through an organization of a committee, for the discussion of electric range problems and the promotion of the sale and use of this appliance would undoubtedly be of great benefit to all concerned.

At the same time the sub-committee was reluctant to make any definite suggestions to the manufacturers themselves in the matter for fear that what was suggested might be misunderstood, or that the Association of Manufacturers, if formed, might not confine its work to such matters as would at all times be agreeable to the central stations.

The licensee arrangement under the Marsh patent, will, we are informed, necessarily include all manufacturers of electric appliances, and this arrangement will no doubt point toward an association of manufacturers. The sub-committee is of the opinion that such an association is likely to be of inestimable value in connection with the handling of suggestions from central stations or from a committee representing central stations. In addition, such an association formed, following the licensee arrangement referred to, would no doubt be of the greatest value to the manufacturers themselves in the development and merchandising of the electric range.

Experience of Central Stations.

Compilation of data in answer to questions addressed to forty-six operating companies shows the following facts:

Types of ranges sold up to the present time have been the products of five manufacturers, all but one of whom have been making various electric appliances for some years past. There were 4659 ranges reported sold, the majority of those apparently giving good satisfaction both as to operation and number of burners and sizes of ovens. The principal mechanical complaints were burning out of elements, slowness of operation and fragile construction. There seems to be a variance in opinion regarding the relative merits of the open coil and enclosed burners, the former apparently being the more popular. The type of electric range most desired seems to follow the lines of the popular gas ranges. There should be four 3-heat burners on the top (one 1500 watt; two 1000 watt; and one 750 watt). The side and upper ovens are by far the most popular. Ovens should be at least 12 by 15 by 18 in. and should contain a broiling element and a baking element. A warming oven above or below the baking and broiling oven is a desirable adjunct. The doors on side ovens should open down.

Installation.—After an electric range is sold it is important that the installation should be of a proper character and at a reasonable cost. It is apparent that the variation in cost of installation—that is, from the meter in, depends largely upon local requirements. In some localities the standard of construction required is much higher than in others—hence the variations in the cost of installation. About two-thirds of the companies do the necessary wiring from the meter to the range, and install the range itself. The remaining one-third do no wiring but deliver the set up ranges when sold by them. Apparently the companies putting out the greatest number of ranges are doing all wiring in connection with installations. Costs of installing electric ranges in consumers' kitchens vary from $4 to $30; the average being approximately $12.50. All companies make installations of electric ranges at cost excepting eight who charge a profit of 10 per cent.

Merchandising.—There are many ways and methods of selling electric ranges to consumers, and these indicate a considerable variation of opinion as to what are the best means to be adopted. The answers to the questions seem to demonstrate that in order to create an interest in electric cooking and promote the use of electric ranges, the central stations had better handle the business, at least in the early stages, and make installations to consumers at cost, or as near to cost as it is possible to reach. Most companies sell electric ranges to their customers, one-half at cost and the other half at a small profit. Apparently very few dealers have become interested in the sale af electric ranges up to the present time. The majority of companies reporting state that dealers are not handling electric ranges and consequently there is little chance to cooperate. As the more progressive central stations find it necessary to make first installations of ranges at cost or with such small profit that, for a while at least, dealers will not be able to see much that is attractive in electric range installations.

The principal difficulties in selling electric ranges, indicated by companies reporting, are the following; their importance being in the order given:

(a) First cost (including installation);
(b) Anticipated high operating cost;
(c) Lack of economical water heating facilities;
(d) Slow operation;
(e) Skepticism and lack of confidence;
(f) Disposition of old equipment;
(g) Satisfaction with present means of cooking.
(h) Necessity for heating kitchen during winter months.

A large number of electric range installations are reported to be made upon deferred payment plans, the limit of payment varying from three to twelve months. The majority of companies endeavor to hold the limit of payments down to a six-month period, but fully one-half of the companies reporting seem willing to make sales on deferred payments extending beyond six months.

About one-third of the companies reporting state that they sell electric ranges on deferred payments at the same prices as for cash. The remaining two-thirds report that they make additions to the cost price varying from 5 to 15 per cent, the average being 10 per cent advance when purchases are made on a deferred payment plan.

Excepting in three instances, all companies reporting state that they maintain display rooms in their offices.

With two or three exceptions all companies reporting state that they select the best of each manufacturer's products to suit their local conditions. The exceptions state that they order from one manufacturer only, so as to obtain quantity prices.

The average consumer apparently is not willing to pay more than $30 to $40 for an electric range but he can be educated to raise the price if the reasons given are satisfactory. The majority of companies report that the average consumer will pay a price varying from $40 to $50 to get the type of range desired. The average of a few of the companies reporting seems to be in the neighborhood of $50.

The majority of companies reporting believe that, under present conditions, the lowest priced range which would at the same time be durable and efficient, should be from $30 to $35 and contain at least three burners with a side or upper oven. A number of companies fear the results of putting ranges upon the market which may be low priced at the expense of durability and efficiency, believing that ranges of this character will do more to hurt the electric cooking business than to help it.

Other fuels naturally compete with electricity for cooking purposes. Thirteen companies report no gas competition. Eight companies report operating gas properties alongside of their electric properties. The remaining companies report either natural or artificial gas at rates varying from 68 cents to $1.60 per 1000 cu. ft. the heat units varying from 550 to 1000 B.t.u. Companies selling gas as well as electricity do not seem to be inclined to put the electric range in competition with the gas range. Most of the companies operating electric properties report the majority of their sales of electric ranges in territory not supplied with gas service. However, one company whose electric range sales have reached large proportions, reports that about 31 per cent of their sales of electric ranges have been made in territory not served by gas, and 69 per cent in territory supplied with gas service.

The varieties of fuel outside of gas with which the electric range would have to compete, are numerous, comprising coal, wood of different qualities and varying expense, coal briquets, crude oil, kerosene, gasoline and distillate. In some of the mountain states coal is as low as $3 per ton and wood as low as $2 per load. The price of crude oil for stove purposes is approximately 3 cents per gallon; kerosene, approximately 16 cents per gallon; gasoline, approximately 18 cents per gallon and distillate approximately 8½ cents per gallon. The reports from various companies indicate that where gas is not supplied as fuel, the electric range competes with different kinds of fuels according to the geographical location. In some states coal is the principal competitor. In other states wood is almost the only competitor and in other states, principally in the south, oil is largely the only competitor because of its cheapness and because other fuels, (coal and wood) are relatively high priced.

In the territory where there is no gas competition, the principal reason the average consumer will not buy and use an electric range is that he is not familiar with the advantages of electric cooking. Some companies report that the very low cost of wood (mill refuse) for fuel, prevents the consideration of electric range installations. Several of the companies report the water heating difficulty as an obstacle and also the necessity of having heat in the kitchens several months of the year on account of climatic conditions. The financial conditions during the past two years are also given as a reason by two or three companies why more interest has not been created in this subject.

General Merchandising Information

With the idea of obtaining all the information possible bearing upon this subject as a result of the experience of the companies reporting, some leading questions were asked, and the replies received are mostly practical and entirely interesting.

The following quotations give the ideas of some of the companies on dealing with manufacturers in order to obtain an ideal electric range at the lowest possible price:

"The manufacturer should be willing to stand behind his product with a proper guarantee, and willing to defer some of the profits from the business until a future date, and not hope to make all on the first few ranges sold, but bring the price down as low as possible and let the central station have an opportunity to put out more ranges."

"Standardize requirements of the central stations so as to limit the types of ranges made by different manufacturers and thus reduce their overhead expenses. Also show manufacturers that increased output depends primarily upon lower priced ranges."

"Develop hot water attachment and durable elements."

"It seems as if a canvass of number contemplated to be used would allow greater number to be made and this would allow cut in price, or manufacturing company could sign tentative contract to sell at certain

reduced price if certain specified number were ordered by entire trade."

"Power companies to combine in order to secure quantity prices."

"Standardization of types should reduce production costs. Some method of collective bargaining between representatives of the manufacturers and central stations to establish standard designs for a predetermined period might work to the mutual advantage of all concerned."

"Standardize and cut out novelty idea."

"A maximum production to lower unit cost."

"Through increased output; central stations could club together and order a certain number in advance."

"Dispense with nickel and frills unless especially ordered."

"Standardize so as to cut down manufacturers' cost."

Shipment of 60 Electric Ranges Installed in Santa Ana District of Southern California Edison Co.

"Study the gas range closely and capitalize its experience."

"Let the electric manufacturers make the element and the stove manufacturers make the stove."

"Ship complete line of repair parts to the distributor."

"Manufacturers should be more particular in details and mechanical construction."

"Do not load the development cost on first shipments."

"Better insulation in oven on cheaper ranges."

"Standardize on design and equipment. Reduce number of types of ranges and talk quantity to the manufacturers."

The following quotations give the ideas of some of the representative companies as to methods of special value.

"Install one in each community on trial and use it as a demonstration."

"Personal solicitation and demonstration."

"Expert instructions and frequent visits for tests."

"Get an efficient range properly installed in a consumer's residence. That consumer, satisfied, will use the range and talk about it, which will be the best advertisement for same."

"Deferred payment plan. General use of electric ranges among company employes. Testimonials of satisfied users of the ranges. Demonstrations on large scale, as well as follow-up work of all new intallations by demonstrators. Domestic science equipment in the schools. Continuous publicity work as to the advantages of electric cooking."

"Thirty days' free trial."

"Cooking schools and demonstrations. Salesmen to follow up prospects closely."

"Install range on trial; a good conscientious salesman will make it stick."

"Judicious advertising and personal letters."

"Sell range installed on small monthly payments, making allowance for old equipment."

"Personal solicitation by well informed, enthusiastic salesmen has done most for us. No one plan, however, can be relied on altogether. Any well directed method of educating the public will prove a good merchandising method."

"Personal solicitation. Don't wait for the customer to go to the demonstrations. Let the salesman make an appointment and bring the customer to the office and give a special demonstration and close the sale. After the installation is made, don't wait for the customer to send in a complaint. Anticipate the complaint. Call upon the customer regularly to inquire and give information and call the customer up on the telephone between personal visits. The satisfied customer immediately becomes a salesman without pay."

Expectation as to number of ranges to be sold in the West during 1916 total ten thousand.

(To be continued.)

FEASIBILITY OF ELECTROCHEMISTRY AT THE DALLES.

BY O. F. STAFFORD.

(Concluded.)

Phosphate Industry.

In the discussion of raw materials earlier in this report it was stated that eventually the major reserves of phosphate rock existing in the territory just east of the Oregon line must be called upon to supply the demands of agriculture for phosphate fertilizer.

Unfortunately the technology of the treatment of phosphate rock in a large way in the electric furnace or by other electrical methods is still in a pre-commercial stage to a degree which makes any attempt to subject it to a close analysis quite out of the question. The most that is known about this matter is that much research energy accompanied by very large outlays of money for the experimental work, is actively engaged upon the problem, with now and then a statement being thrown out indicative of satisfactory progress.

For example one of the principle interests engaged in this endeavor has asserted that it is possible to turn out phosphoric acid by use of the electric furnace at a cost somewhat less than the present cost of the same as produced in the form of super-phosphate by standard practice using phosphate rock and sulphuric acid. To be sure the power rate necessary for this is a very low one, being given as $5 per horsepower-year. It has been announced, moreover, that this particular interest expects to develop the power existing at the outlet of Lake St. John, Canada, where it is said that upward of a million horsepower can be obtained at a cost not greater than the above named figure, and at this site establish a plant to handle

phosphate rock shipped by water from the southeastern states.

The details in the above paragraph are of interest, of course, simply as an indication of what is being striven for in this department of the phosphate industry. From it, however, it may also be seen that in spite of the long distance of this power site from the raw materials and from the final market, and in spite, too, of the fact that for five months in the year water transportation will be closed by ice, the project is under serious consideration. It consequently may not be hoping against hope that in time our western water powers may be used in connection with our phosphate deposits even though it is doubtful about ever securing any of this power at a rate as low as $5 per horsepower-year.

The industrial situation however, into which such an enterprise would enter may be roughly outlined.

Present super-phosphate practice yields by the use of phosphate rock and sulphuric acid a material containing only 18 per cent phosphoric acid. The cost per pound of the phosphoric acid under Atlantic Coast factory conditions is given at 2 cents, assuming a price of $4.50 per ton for high grade phosphate rock and $4.75 per ton for sulphuric acid. In Montana, making use of local phosphate rock and the cheap sulphuric acid produced at a smelting center such as Anaconda, it is estimated that phosphoric acid in the form of super-phosphate would cost only 1.3 cents.

Since over 80 per cent of the above product would be useless as phosphate fertilizer its radius of distribution would be limited as compared with any product richer in active phosphoric acid. Now electric furnace methods, if successful at all, would turn out highly concentrated forms of phosphate material and, always provided that unit costs are not too far apart, these could enter competitively any region not near to conjoined sources of both phosphate rock and sulphuric acid such as exist in Tennessee and Montana.

It is the concensus of opinion among those who have given much study to the question that the logical product for an installation attempting to make phosphate fertilizer by aid of electrical power is ammonium phosphate. This substance would be ideal from every point of view—its suitability as a fertilizer, containing as it does both phosphorus and nitrogen, as well as representing forms of both so concentrated that it could go easily into the world market. Its manufacture would involve the use of one of the hoped-for electric furnace methods of making phosphoric acid and also one of the methods discussed abve for obtaining ammonia from atmospheric nitrogen.

In Conclusion.

The survey of electrochemical industries undertaken in the interests of the possible utilization of the water power at The Dalles, Oregon, by electrochemical manufactures has revealed the following facts:

The electrochemical centers of the East have grown up as the result of peculiarly favorable conjunctions of power, materials, capital, labor and markets.

In the West the single resource which more advantageously presents itself than in the East is power, while owing to the fact that most electrochemical products are "heavy," the matter of market, particularly, which is almost altogether in the East, becomes impossibly remote.

Power cost, moreover, in most of the industries, is a minor charge against the total expense of production and consequently can be increased to points far beyond those at which very large amounts of power are still to be had in the East before neutralizing the other advantages inherent in an eastern location.

Costs of materials, capital and labor are slightly greater in the West than in the East.

Utilization of western water power for electrochemical industries must therefore be limited at present to the manufacture of certain commodities for local consumption or for the Orient. The commodities which might so be made in a very limited way are lye and bleach, cyanamid, chlorates, and possibly calcium carbide. The total consumption of power for these needs probably would not reach 25,000 horsepower.

The utilization of atmospheric nitrogen for the production of ammonium nitrate is a possibility of the utmost importance for the future of the United States agriculturally, industrially, and for purposes of military defense. A power development of the size proposed for The Dalles could be utilized as soon as available for this industry.

There is a more remote possibility affecting the great stores of phosphate rock in the Northwest which, contingently upon the successful outcome of experimental work actively under way and apparently showing indications of success, may be transformed into ammonium phosphate by the help of electrical power and by this means become available for the uses of agriculture the world over.

LETTER TO THE EDITOR.

Hazards of Electric Heaters and Ranges.

Sir: We note in your edition of June 3 an article written by Mr. G. A. Cleary.

This is a very interesting article, but in the last paragraph on page 436 he makes the statement that the General Electric and the Hughes Electric Company individually fuse the elements of their ranges, whereas the Hotpoint Company and some other companies do not.

We have never put out one of our new type electric ranges without each element individually fused. and we feel we have been done a gross injustice by being classed with the manufacturers who do not fuse the elements of their ranges individually.

We will appreciate a public statement from you correcting this error in Mr. Cleary's article.

Very truly yours,

HOTPOINT ELECTRIC HEATING CO.,

P. H. BOOTH, Vice-President.

Ontario, Calif., June 3, 1916.

INDUSTRIAL PREPAREDNESS.

BY GEO. W. DICKIE.

(In the course of a joint meeting of engineers at Los Angeles on June 3rd, Mr. Dickie, as an associate member of the Naval Consulting Board, spoke briefly on this subject. The following remarks are taken from the concluding portion of his address.—The Editor.)

Many people, some of them industrial producers, do not believe in preparedness and think that the oceans that lie between us and a possible enemy will give time for all the preparation necessary. How many of us realize the distance from Great Britain to the Dardanelles? We are accustomed to think of the Mediterranean as a lake; yet it is 290 miles further from the North Sea to the Dardanelles than from Liverpool to New York. I cannot tell you just how many thousand troops were transported exactly the same distance as from Europe to the coast of the United States, landed and waged a campaign against a powerful and fully prepared nation, but I am sure that it was a far larger force than could be successfully repelled by us in our present state of unpreparedness. Our experts in the War College will tell you that it is an easier problem to move a large body of troops a great distance by sea than by land, that it would take a shorter time to transport an army 3000 miles by sea than to move it from New York to California, and yet there are many who insist on closing their eyes to these obvious facts.

Then we meet other people who believe that we should be prepared, but claim that it is the duty of the Government to make preparations necessary, and thus eliminate the incentive of those who would profit by manufacturing war material to urge the nation to war. These people seem to forget that battleships and army corps of themselves do not constitute preparedness. They forget that even munitions today are only one of the many requisites necessary to success in modern war. We are far away from the time when men followed their chief to battle and the problem was not that of munitions, but of muscle in the hour of strife.

For present day war needs, how many of us realize that to produce the gauges and jigs necessary to manufacture the 200,000 shells daily required by an adequate artillery force in action would swamp the facilities of the three largest plants in this country now making these articles, swamp them from now until the year 1921, and that preliminary item alone would cost $18,000,000. In the event of even a medium sized war with a first-class power we would need 120 times our present number of machines fitted and instantly ready for munition manufacture. More than that we would need three men sweating in a factory for every soldier or sailor at the front. If we plan for an army of a million men, and that is not big compared with the armies now at war in Europe, we must also plan another army of three million men to supply the necessary things required by the million in the field. Today the Frankford arsenal is the only one we have equipped for the making of field gun ammunition; if it worked night and day for 365 days it would be able to supply just about enough shells for a single day's shooting, so that in the event of war, to supply ammunition for field guns alone, we would need 365 duplicates of the Frankford arsenal.

Years ago Germany knew how many shells and other mechanical things that were necessary for war, and how many parts each little machine shop in the country could make, and she gave these shops actual practice in making them, so that on the afternoon of July 28, 1914, every concern in Germany that could make munitions was working full capacity on such work, two hours after the declaration of war. Great Britain got ready in about a year. Of course, merely taking an inventory of our manufacturing plants to determine their possibilities in case of war would in itself be useless. These plants must be furnished in advance with all necessary designs and the jigs and gauges for the manufacture of such war material as they are fitted for, and they must be regularly inspected to insure their ability to shift without loss of time from the products of peace to the products of war.

Then our railroads must be ready for the job that war would bring them, should the misfortune of war overtake us. Our 250,000 miles of steel highways would become the very backbone of our power to stand. Yet how little are we prepared to care for the extraordinary quantity of traffic that would be headed for strategic points in that emergency. I would not advocate for our country's railroad tracks to be dedicated to the promotion of war, as Germany did, but I do believe that if our Government would cease considering our railroads as targets for legislative jokes and look upon them as a link, the most important link, in the chain of preparedness, the railroads would soon be able to respond with increased facilites to care for extraordinary needs the Government may have for their service.

In advocating the necessity for preparedness on the part of our manufacturing and producing establishments for the possibility of war demanding the utmost that their plants can produce, I am not one that sees in the near future this country forced to defend itself against a foe seeking a foothold in this country. We have not yet been near to that much dreaded condition. But I can see, not far distant, an industrial struggle in which some of the countries now straining every facility of their industries and working them up to an efficiency hitherto unknown, turning that intensely efficient army of workers on to the arts of peace, and through the power of efficient production they have acquired in this portentous time of struggle and stress, that has brought even their women from the kitchens and offices to the lathes and shaping machines of the factories, in order that they may get possession of markets that we fondly think are ours by right. That invasion, which is not problematical but very certain, needs the same kind of preparedness as the other, and it is the duty of every one who desires to see this country maintain herself as equal to any other people in the world of industry to see that whatever he or she may be engaged in will be prosecuted with the highest obtainable knowledge of the art and the keenest efficiency in practical application of that art.

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Occupational Versus Community Interest

Several national engineering societies and utility associations are bothered by the apathy of many of their members. With increase in size has come diversity in interest. The present problem is how best to unify these diversities.

In general the problem is an old one, and, in time, works out its own solution. According to an invariable law of nature, centralization is followed by sectionalization as surely as night follows day. Furthermore, the cycle repeats itself, just as in the lower forms of life cells multiply to form aggregates, which in turn break apart into smaller nuclei for new aggregations.

The engineering organism found conditions favorable to growth when the distinction was first drawn between military engineers and civil engineers. Civil engineers became the parents of mining engineers, mechanical engineers and electrical engineers. Each of these divisions became the progenitors of new subdivisions, so that among mining engineers there were coal miners, iron miners and gold miners, each with different difficulties; among mechanical engineers there were steam engine men, gas engine men and hydraulic men, and among electrical engineers there were electrometallurgists, more allied to mining than to electricity, radio experts interested in marine engineering, and generator designers interested in steam turbine progress. Many of these in turn are again specializing along narrower lines, and thus the ramifying process continues indefinitely.

One point of common interest and common convenience to different specialists is the community in which they reside. An electrical engineer is usually more interested in the local solution of a mechanical engineering problem than in the foreign solution of some electrical problem. He can meet locally more conveniently and more frequently. So local engineering societies are in successful operation all over the country, sometimes independently and sometimes as sections of the national societies. But because of natural limitations as to paper sources and financial resources these smaller sections tend to get together as larger geographical sections.

Thus the several Pacific Coast sections of the American Institute of Engineers hold annual get-together meetings, the National Electric Light Association encourages district meetings with other utility associations, and the national engineering societies are conferring with a similar object in view. In this way it is possible to combine the advantages of local freedom with national solidarity.

But in order to accomplish this purpose it will be necessary for the national associations to make certain concessions. By so yielding, they will strengthen themselves, as otherwise the community tie will become stronger than the occupational bond. These concessions include the granting of more adequate district

representation, the allowance of more funds for local activities, and a more personal interest in community affairs. The most liberal body in this respect, and perhaps for this reason the strongest, is the American Institute of Electrical Engineers. The national body pays the expenses of a delegate to its annual meeting from each section, it provides funds for local activities and aims to distribute its officers throughout the country. Yet even the institute has not yet seen fit to arrange for territorial vice-presidents.

This writing is a dispassionate presentation of a subject concerning which most Western men are sensitive. They see the inelasticity, waste and inefficiency of centralized power, they fear bureaucracy and they desire representation. Yet they are not provincial. They are broad enough to think nationally and meet half way those of the East who are also big enough to think nationally about local problems. With greater opportunity for unrestricted local development will come increasing national loyalty. Otherwise, community clannishness will supersede occupational loyalty.

Aptitude

Much of hope and encouragement is found in the doctrine that by means of will power a man can make of himself whatever he wants. This is the basis of inspirational writing and the belief has been of material benefit to many a man. No matter how hard the task, it can be brought about by making up one's mind to do it.

Experience has proven that this principle is correct. By the exercise of sufficient will power any man can accomplish wonders in any direction he so desires. Every image that is persistently held in mind is sure to materialize. The men who have moved this world are those who have first brought themselves to a point where nothing was rated too hard as a condition of success. The greater the difficulty, then, the greater is the incentive to overcome it. This is as true today as two thousand years ago, when Demosthenes corrected a natural impediment in his speech and became the greatest orator of his time. Men of purpose accomplish their objects because of will power, willingness to forego personal ease and pleasure in order to win a coveted prize and they count as a delight the self-denial involved.

While the application of the theory that where there is is a will there is a way has been responsible for the attainments of great men it has also caused failure on the part of as many others. It fails to take into account that each individual has certain inherent bents along which progress is easier than in other directions. The same will-power and the same energy applied along the lines of natural aptitude will accomplish more tangible results than if directed against natural inclinations.

There are those who teach that salesmen are made not born. And who is not acquainted with men who might have been fine mechanical designers if they had not become mediocre salesmen. Injudicious use of this argument has put many a square peg into a round hole and caused many a razor to be used for chopping blocks of wood.

Analysis shows that every individual has certain innate characteristics because of which he is better adapted by nature to some tasks than others. How foolish and wasteful, then, is it for him to try to fit himself to some occupation for which he has no aptitude.

Yet that is precisely what our schools are attempting every day, the usual defense being that the training of the mind and of the will power is a sufficient recompense for the time spent in a given subject, even though actual proficiency is not obtained. Under the title of "Aptitude as a Basis for Education" this subject is sanely discussed by Sanford A. Moss, an engineer with the General Electric Company, in the June Bulletin of the Society for the Promotion of Engineering Education. He defines aptitude as "the ability to reach a conclusion without conscious reasoning, and lack of aptitude is the necessity for tediously going through each step in a chain of reasoning and finally deducing the conclusion explicitly."

Every man has some ability in some direction. Aptitude marks the direction of that ability. Mr. Moss argues that the more an aptitude is developed the greater the chance of general success. He admits that by sheer labor almost anything can be acquired, but there never can be true success without aptitude. He shows that concentration, memory, reasoning power and all such general qualities can be developed as well in one way as in another and concludes that general culture and broadness can be imparted by learning about a thing without necessarily learning how to do it.

Consequently he suggests that the apt and the inapt students in any subject be segregated, that the apt be instructed in the actual handling of the tools and that the inapt be taught of the subjects merely as interesting branches of human knowledge concerning which they should have a general understanding without attempting to acquire proficiency.

This suggestion seems reasonable not only as regards college students but all persons in general. With better vocational guidance there would be less industrial inefficiency. In this way it would be possible to mitigate the inexorable law of the survival of the fittest by transferring those who are unfit in one field to an environment to which they are better fitted. By a more scientific selection of employes it would be possible to lessen the annual turn-over of workers and thus increase the annual turn-over of product. Then after a judicious selection of the aptitude, the direction, let the great achievements be accomplished by the exercise of will power.

PERSONALS

Frank Somers of the Century Electric Company of San Jose, Cal., is at Fresno.

A. H. Babcock, electrical engineer Southern Pacific Company, is spending three months off the New England coast.

H. H. Courtright, manager Valley Electric Supply Company, has returned to Fresno from San Francisco.

H. E. Sanderson, Pacific Coast representative of the Bryant Electric Company, returned last week from the Northwest.

S. P. Russell, manager of the electrical department of the H. W. Johns-Manville Company at San Francisco, is at Los Angeles.

G. S. Nickerson, irrigation engineer of the North Fork Ditch Company of Sacramento, was a recent business visitor at San Francisco.

Guy W. Talbot, president of the Pacific Power & Light Company, has been elected chairman of the civic bureau, the Portland Chamber of Commerce.

Wynn Meredith, a member of the firm of Sanderson & Porter, is at Tulsa, Oklahoma, where he is opening a field office to handle oil pipe line construction.

H. J. White, sales agent Keeler-White Company, leaves for the East this week to be gone six weeks or more. He will return via Spokane and the Northwest.

C. R. Hunt, manager of the Robbins-Myers Company at San Francisco, recently returned from a two weeks' business trip throughout the southern part of California.

L. G. Cushing, factory representative of the Connecticut Electric Manufacturing Company of Bridgeport, Conn., is visiitng the Pacific Coast, now being at Los Angeles.

Grattan Kerans, who for four and a half years was associate editor of The Jovian, official organ of the Jovian Order, on June 1 returned to the editorial staff of the St. Louis Post-Dispatch.

W. I. Otis, Pacific Coast agent for the Detroit Fuse and Manufacturing Company and other lines, has returned to San Francisco from the southern part of the state and announces a successful trip.

Ray Murphy, assistant Pacific Coast manager Westinghouse Lamp Company, has recently returned to San Francisco from an extended business trip to Los Angeles and Southern California.

B. J. Klein, Pacific district manager of the Bristol Company of Waterbury, Conn., will return to San Francisco the first part of the week from an extended business trip throughout the Northwest.

A. J. Myers, Pacific Coast manager of the Wagner Electric Company, is expected to return to San Francisco from a three-week business trip throughout the southern part of California about the end of the week.

J. W. Meek, formerly Pacific Coast manager for the Bessemer Gas Engine Company, now connected with W. J. Wallace and his associate companies at Los Angeles, was a recent visitor at San Francisco.

Franklin T. Griffith, president of the Portland Railway, Light & Power Company, has returned from a trip east to confer with the other member of the executive committee, of which C. M. Clark is chairman, at Philadelphia.

John Hunt, purchasing agent of the Pacific Gas & Electric Company, and **John D. Kuster,** San Jose manager for the same company, have just returned from a trip East by way of New York and Washington, having stopped at the N. E. L. A. convention.

N. Abrams, president of the Western Agencies Company of San Francisco, has returned from the southern part of California and reports good business. He has established a branch office of the Western Agencies Company at Los Angeles.

W. C. Wurfel, Pacific Coast manager Westinghouse Lamp Company, has returned from a trip to Eastern cities, visiting the various lamp factories; participating in the annual meeting of district managers of his company at New York; and attending the Chicago convention of the National Electric Light Association.

Eugene V. Griffes has resigned as secretary and general manager of the Oceanside Electric & Gas Company, of Oceanside, Cal., with the acquisition of the company by the San Diego Consolidated Gas & Electric Company, for whom **A. S. Glasgow** will act as resident manager at Oceanside. Mr. Griffes incorporated and designed the equipment for the Oceanside company in 1904, since which time he has had charge of the company's affairs. He will leave Oceanside in July and make his home at Pasadena and Point Firmen, Cal.

W. H. Clarke, manager of the bond department of H. M. Byllesby & Company, has returned to the Chicago office from an inspection of the utility properties in which his firm is interested in California. It was Mr. Clarke's first visit to California and he is decidedly optimistic on the prosperity of that state in the immediate future. "The banks of the cities are carrying large balances," he says, "and many development plans are in motion which promise gratifying results. No one can come away from California without a deep impression of the energy and creative and productive ability of the people of that state. The public utility properties in which we are interested, namely the San Diego Consolidated Gas & Electric Company, and the Western States Gas & Electric Company which serves communities centering at Stockton, Richmond and Eureka, are doing splendidly. They do business in territories which are both stable and growing, and have succeeded admirably in pleasing the public. The people of San Diego have responded cordially to the opportunity to invest in the new preferred stock of the San Diego Consolidated Gas & Electric Company and the patrons of the Western States Company are to be offered the securities of that company soon."

OBITUARY.

E. N. Fobes, president of the Fobes Supply Company of Seattle and Portland, was killed by the capsizing of his automobile near Noyesburg, Sutter county, California, on the morning of June 5. Mr. Forbes was making an automobile tour throughout California. He was well known to all electrical supply men on the Pacific Coast and his accidental death comes as a severe shock to his many friends.

A. D. Houghton, a prominent mechanical engineer, died at Santa Cruz, Cal., June 5, aged 51 years. Before coming to California ten years ago Dr. Houghton was in the employ of John D. Rockefeller, and was architect and builder of the Rockefeller Hall Library. He also designed the heating and electric light plants of the University of Chicago, the power plant and water system of Bryn Mawr College and the heating plant at Wellesley College. During the Spanish-American War he entered the naval service as assistant engineer at Boston Navy Yard. He is survived by a widow, two sons and a daughter.

TRADE NOTES.

The Power Equipment Company has moved from their quarters in the Rialto Building to 405-407 New Call Building, San Francisco.

The Central Electric Company of San Francisco has secured the wiring and equipment contract for the Old City Hall on Eighth and Market streets. The building is seven stories and covers about 220 by 137½ feet.

A. S. Lindstrom, Pacific Coast manager of the Thordarson Electric Company; R. E. Frickey and H. M. Bloch have recently combined and formed a company known as the "Efficiency Products Company." The first product that they expect to put on the market will be the Epco Electric Water Heater for household purposes to be installed in connection with electric heating and cooking appliances.

MEETING NOTICES.

San Francisco Electrical Development and Jovian League.

With Mr. Percy Pitts of the Pacific Gas & Electric Company as chairman of the day, the League luncheon of May 31st combined much of pleasure and profit. Mr. Pitts introduced Mr. C. E. Grunsky as the principal speaker, Mr. Grunsky telling, in a most interesting manner, of his personal experiences as a member of the first Panama Canal Commission. His account brought home to all the stupendousness of the task and the wonder of the accomplishment. Announcement was made of rapid progress in perfecting plans for a great joint Jovian rejuvenation at Trestle Glen, Oakland, on the night of June 10th, both San Francisco and Oakland joining forces in what promises to be the most spectacular affair of its kind ever held.

Joint Engineering Meeting at San Francisco.

A joint meeting of the members of the various national engineering societies was held at the Engineers' Club, San Francisco, on the evening of June 2. Brief addresses were made by the local chairman of each society as well as by President Bumsted of the club, he congratulating the members on their ability to assemble thus harmoniously on neutral ground. Mr. A. V. Thompson of the General Electric Company gave an interesting lantern slide talk on "The Electrification of the Chicago, Milwaukee & St. Paul Railroad," the first instance in which electric haulage of through freight and passenger trains on a large steam railroad system has been accomplished primarily to effect a saving in cost of operation. The high cost of coal throughout the entire 440 miles of electrification and the low cost of hydroelectric power under similar conditions is expected to bring about a great saving to the St. Paul, judging from the 36 per cent saving in operation shown in the first year of electric operation of the Butte, Anaconda and Pacific.

The 42 locomotives are hauling 15,000 tons per day east bound and 10,000 tons per day west bound over the transcontinental divide. The freight and passenger locomotives are identical except in gear reduction being 4.56 and giving a speed of 16 miles per hour when hauling a 2500 ton trailing load on 1 per cent grade with the freight locomotives and 2.43 with the passenger giving a speed of 30 miles per hour with an 800 ton train on a 1 per cent grade. The locomotives consist of two 4-wheel bogie truck units, there being 8 drivers and 8 1500 volt motors, arranged two in series. Direct current is delivered at 3000 volts to the locomotives from an overhead trolley supplied by the Montana Power Company through a total of 14 substations, spaced at an average distance apart of 32 miles, the total substation capacity for the 440 miles of track being 59,500 kw., or about 15,000 kw. for a division.

By means of regenerative braking each motor acting as a generator, a 3000 ton double-header can be dropped down a 2 per cent grade at a uniform speed of 18 to 20 miles an hour without the application of air brakes and also returning power to the system. This return amounts to an average of 14 per cent and a maximum of 40 per cent of the power used. The saving in brake shoes and wheel wear is almost as important as the saving in power.

The approximate cost of the electrification was $11,100,000, of which the 42 locomotives represented $1,800,000, the 14 substations $1,800,000, the trolley and feeder system $3,600,000, and the transmission line $1,200,000.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The Plumas Light & Power Company, Plumas county, has applied to the commission for authority to issue bonds to refund its outstanding indebtedness and to make extensions and betterments. The improvements are estimated at $7650.

The commission has authorized the Southern Counties Gas Company of California to purchase the gas properties of the Southern California Edison Company, and of the Long Beach Consolidated Gas Company. The Southern Counties Company pays $1,050,000 for the Edison Company's properties and $950,000 for the Long Beach property. The commission also authorized the Southern Counties Company to issue $2,500,000 20 year 5½ per cent bonds and $660,000 6 per cent preferred stock. The sale of bonds and stock will net $3,000,000.

The Los Gatos Telephone Company has applied to the commission for authority to issue capital stock of par value of $1500 to pay note held by Bank of Los Gatos.

The Pacific Telephone & Telegraph Company and the Sunset Telephone & Telegraph Company have filed a joint application with the commission for authority for the Sunset Company to sell to the Pacific Company all its property and assets in California. Consideration of sale, $10. Capital stock of Sunset Company is $15,000,000, all owned by the Pacific Company.

The California Telephone & Light Company, with its principal office in Santa Rosa, has applied to the commission for authority to issue and sell $25,000 face value of its first mortgage 6 per cent gold bonds, maturing in 1943, at not less than 94 per cent.

The commission has authorized the Reedley Telephone Company to issue 951 shares of its capital stock at $1 par value at not less than 90, to reimburse treasury for moneys expended.

The Martinez and Concord Interurban Railway Company has filed with the commission a second amended application changing the route of its line, and for authority to issue and sell 600 shares of its capital stock at $80 per share and $125,000 face value of its first mortgage bonds at 90 per cent.

The commission has authorized the San Diego Consolidated Gas & Electric Company to buy on or before September 1, 1916, the entire issued capital stock of the Oceanside Electric & Gas Company, 1819 shares, at $14 per share.

The commission has authorized the San Francisco-Oakland Terminal Railways to issue $180,000 of 6 per cent equipment notes to pay in part for 32 new railway cars. The notes are to be in denominations of $500 and $1000 to be callable at 100½ on 60 days' notice and to mature at the rate of $10,000 every six months beginning May 1, 1917.

The commission has authorized the Corona Gas & Electric Light Company, operating in the city of Corona, Riverside county, to execute a first mortgage on its properties as security for an issue of $58,500 6 per cent 50 year bonds.

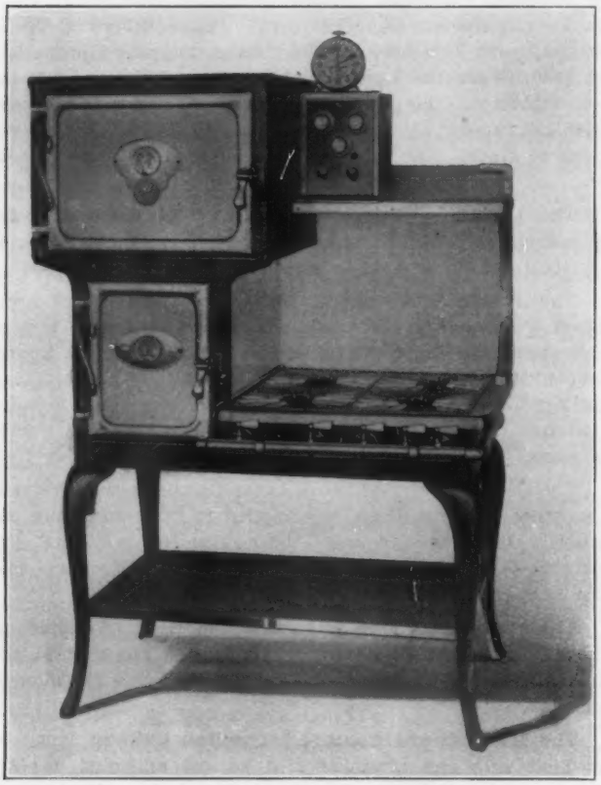
The Western States Gas & Electric Company has filed with the commission an application for approval of expenditures for plant improvements of $10,759.17.

The Santa Maria Gas & Power Company, which furnishes natural gas in Santa Barbara and San Luis Obispo counties, has filed with the commission an application for authority to issue $40,000 par value of its 6 per cent gold bonds, at par and accrued interest, the proceeds to pay in part for the construction of a distribution system in San Luis Obispo.

The Lindsay Home Telephone & Telegraph Company, of Lindsay, Tulare county, has filed with the commission an application for authority to issue $15,000 of 6 per cent 18 year bonds, at 93, to execute a deed of trust to secure this amount, and to adjust its rates.

COMBINATION GAS AND ELECTRIC RANGE.

In the new line of electric ranges now being placed on the market by the Westinghouse Electric & Manufacturing Company is a novel type, in which the four stove top electric heaters have been replaced by four gas burners. This makes possible the use of gas on top of the stove and electricity for the oven. In the center of the four burners is an automatic



Westinghouse Combination Gas & Electric Range.

gas lighter, controlled by a button valve in the front of the stove.

The oven equipment of the combination range is identical with that in the Westinghouse standard type of electric range, a large oven 18½ by 13½ in. by 16 in. deep, requiring 2000 watts and a smaller oven 10⅜ by 13½ in. by 11½ in. deep, requiring 850 watts. Three indicating switches are provided for oven heaters. A one-oven range is also manufactured, requiring 2000 watts. Automatic time and temperature control is provided.

ELECTRICAL BASEBALL LEAGUE.

Standing of Clubs.

	Won.	Lost.	Per Ct.
Pacific States Electric Co.	6	0	1000
Western Electric Co.	4	2	.666
Electric Ry. & Mfg. Supply Co.	2	4	.333
Electric Appliance Co.	2	4	.333
General Electric Co.	1	5	.166

June 3rd Results.

Elect. Appliance Co.	8	Pacific States Elect. Co.	9
General Electric Co.	2	Western Electric Co.	4

No other game scheduled.

Electric Appliance Company vs. General Electric.

The Electric Appliance Company defeated the General Electric Company in one of the fastest games of the season by a score of 7 to 2. Pitcher Long of the Electric Appliance Company kept his hits well scattered, where Pitcher Wiseman of the General Electric Company was unfortunate in having them bunched in the sixth inning, when six runs were scored by the winners. The feature of the game was the playing of Keck at first for the Electric Appliance Company, accepting a number of wild throws, in connection with making a double, unassisted. The game was played in the remarkably short time of 1 hour and 25 minutes.

Pacific States vs. Western Electric.

One of the best games of the season was played last Saturday afternoon, when these teams crossed bats. The game was full of exciting moments, as both of the teams are on top in the race for the beautiful trophy which the Electrical Baseball League has put up for the team finishing first at the end of the season, which is scheduled for July 29, 1916.

The fans watching this battle were kept awake every minute of the game, as the heavers of both teams got in some tight places, but O'Connell of the States showed his superiority when he struck out two men with two on the bags. A pretty double steal was enacted in the fourth inning by Markowitz and Kennedy of the States. Lorgan of the Western Electric drove a nice one out to centerfield, which seemed to start a rally in the second inning, and allowed two runs to come in, leaving the score two to four in favor of the Western Electric. Kahn, the States star first baseman, came through with a beautiful bingle in the fourth inning and just at the right time, which started the rally of the inning, in which five runs were brought over the rubber.

The Western Electric boys tried hard to redeem themselves in the remaining innings; several of them hit the ball, but, alas! Good fielding found them put out before reaching the bag.

The game was called at the end of the sixth inning on account of the lateness of the hour, with the States again defending their title as league leaders, with a score of nine to four.

NEW CATALOGUES.

Crocker-Wheeler Nine-Inch Fans are illustrated and described in a recent circular.

"Better Industrial Lighting" is the subject of a new booklet which has been prepared by the publications committee of the National Electric Light Association, to be purchased by electrical companies for distribution among lighting prospects. The arguments are convincing and the illustrations of good lighting practice are right to the point.

A NEW TRANSFORMER OIL.

Lectroseal (L. S.) oil is a new grade of insulating transformer oil recently introduced by the Westinghouse Electric & Manufacturing Company. This oil has its chief application as an insulating and cooling medium for use with all classes of oil insulated distributing and power transformers. It is also used with such apparatus as induction type feeder regulators and electrolytic lightning arresters.

Lectroseal is a pure mineral oil, obtained by the fractional distillation of petroleum and is free from moisture, acid, alkali and sulphur compounds. As an insulating medium, it has a high dielectric strength. The average breakdown test is said to be 40,000 volts on a .15 in. gap between spheres ½ in. in diameter. As a cooling medium, it is claimed that this is particularly well adapted, the viscosity being very low (approximately 36 at 40 degrees C. Saybolt method.) Consequently, the oil will circulate rapidly and transfer the heat quickly from the transformer or other apparatus to the walls of the tank. If water should accidentally enter a transfer tank, it should sink to the bottom of the tank as quickly as possible, as a small percentage of water thoroughly mixed with the oil reduces its dielectric strength very rapidly. Various grades of oil differ greatly as to their ability to separate from water with which they have been mechanically mixed, but Lectroseal oil, it is claimed, possesses this quality in a marked degree.

The other characteristics claimed for Lectroseal oil, such as freedom from deposit, satisfactory flash and fire point, low rate of evaporation and light color, would indicate that this is practically ideal for the purpose for which it is intended.

NEWS NOTES

ILLUMINATION.

SANTA BARBARA, CAL.—Concrete posts are to be used for the ornamental lighting system on State street.

PASADENA, CAL.—The city commission has ordered the construction of underground conduits in Lester avenue with appurtenances for carrying light, power and other wires.

SAN DIEGO, CAL.—The bid of B. Rose & Company for the installation of electric lighting equipment on Fourth street between E and G streets has been accepted by the city council at $2042.

RIDDLE, ORE.—A. E. Brais has formally accepted a franchise providing for an electric light and power business here. Mr. Brais has just completed estimates of cost of material, etc., and construction work is to start on the system soon.

RIVERSIDE, CAL.—Protests will be heard on June 13 regarding the proposed improvement of Highland Place between Brockton avenue and Suman Tract, by the installation on each side of the street of electric poles, conduits and lamps.

WALLACE, IDAHO.—The city council has authorized the installation of a system of incandescent lighting throughout the city, outside of the district now lighted by the cluster system. Installation will be started as soon as material can be secured.

POMONA, CAL.—The city council has ordered the construction of concrete posts, wires, conduits, lamps and appliances for street lighting purposes in Alvarado street, Columbia avenue, Lincoln avenue, and certain other streets in conformity with plans on file with the city engineer.

COEUR d'ALENE, IDAHO.—Immediate steps toward the construction of a new light and water plant to be owned and operated by the municipality, or the purchase of the present plants furnishing light and water to the city was recommended by the fire, light and water committee of the city council.

POMONA, CAL.—Immediately upon assuming control of the local gas business which it is purchasing, the Southern Counties Gas Company will remodel the plant. Old machinery will be removed, and new equipment installed. The next move will be to connect the gas mains of Covina with those of Glendora and Azusa. The Covina plant will then either be used as a relay station or else abandoned.

PHOENIX, ARIZ.—Petitions to initiate an ordinance to authorize the purchase or erection of a gas and electric plant here will be started in circulation within a few days. The present plan is to issue bonds in the sum of $600,000. The city engineer has submitted figures showing that it would cost about $840,000 to build a new plant thoroughly equipped. It may be decided to purchase the plant of the Pacific Gas & Electric Company.

TRANSMISSION.

VENTURA, CAL.—The Ventura Light & Power Company is getting ready to install at a cost of about $10,000 two substations in this district. Work will begin at once.

LAGUNA BEACH, CAL.—Officials of the Pacific Light & Power Company have announced that within the next few months they propose to erect a power line to Laguna from Newport Beach.

LAKEPORT, CAL.—At the annual meeting of the directors of the Mt. Konocti Light & Power Company, announcement was made that the company is extending its power line to Saratoga Springs and up Middle Creek to Lymans, and also figuring on extending the line to Blue Lakes and Laurel Dell.

FALL RIVER MILLS, CAL.—The California Power & Manufacturing Company is using every effort to get its irrigation system into service for use during the present season. About 60 miles of wire have been strung to furnish power to flour mills and ranches throughout a large section of Shasta county. The irrigation plant will cost approximately $50,000.

QUINCY, CAL.—The Great Western Power Company has acquired possession of the Humbug Valley property formerly owned by the Oro Electric Corporation, according to announcement made here. The property will be used by the Great Western in the development of the series of great power plants. It is proposed to divert the water by a long series of tunnels, flumes and concrete ditches from the Big Meadows dam to Humbug Valley, where it will be dropped to the North Fork of Feather River to the new power plant. The ultimate construction cost of the new system of water supply and the new power plant will be approximately $25,000,000, according to officials of the company.

TELEPHONE AND TELEGRAPH.

WENATCHEE, WASH.—The Bell Telephone Company will rebuild its lines between Waterville and Pateros and Oroville and Molson this summer.

SAN DIEGO, CAL.—Improvements in the local system of the Pacific Telephone & Telegraph Company, involving an expenditure of $25,000, will be started immediately according to the local manager.

BELTON, MONT.—The Northern Idaho & Montana Power Company has completed a telephone line between Columbia Falls and Belton, the western gateway to Glacier National Park, and to Lake McDonald, one of the resorts in the Park. This line will carry considerable business during the tourist season.

FRESNO, CAL.—Authorization for the expenditure of approximately $36,000 to enlarge the service to take care of the new districts, to place wires underground and to make general improvements in towns near Fresno has been made by the general office of the Pacific Telephone & Telegraph Company, and it is thought that the work will be finished within the next eight months.

IRRIGATION.

SAN JOSE, CAL.—Property owners interested are organizing the Laguna Seca Reclamation District near Coyote (about 12 miles south of San Jose) Santa Clara county, California. The District will embrace about 1200 acres of lands, which have been more or less overflowed in the past, and embracing the Laguna Seca. Plans for the drainage canals (about 4 miles in length) are being prepared. The work will embrace about 100,000 cubic yards of earth excavation, also bridges, gates, culverts, etc. Bids will be called for early in July. Duryea, Haehl & Gilman, Humboldt Bank Building, San Francisco, are the engineers.

SALEM, ORE.—The Desert Land Board has received notification that the Department of the Interior had granted the state's application for a five years' extension of the state's contract with the government for the completion of the Morson Land Company's project near La Pine, in Crook county. This project is known as Oregon segregation list No. 11 and comprises 27,000 acres. The granting of the extension to the state will result in the state granting the Morson Land Company an equal extension on its contract with the state and will mean, it is said the immediate pushing to completion of the west unit of the project, comprising about 10,000 acres. To complete the west unit will cost about $10,000.

ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page following

A-1 American Ever-Ready Works of National Carbon Co.. Los Angeles; 755 Folsom St., San Francisco; Seattle.

A-2 Atchison, Topeka & Santa Fe Railway Co..... 673 Market St., San Francisco; 1218 Broadway, Oakland.

B-1 Baker-Joslyn Company..... 3
71 New Montgomery St., San Francisco; 911 Western Ave., Seattle; 353 E. Second St., Los Angeles.

B-2 Benjamin Electric Manufacturing Co..... 590 Howard St., San Francisco.

B-5 Bridgeport Brass Co..... 4
(See Pierson, Roeding & Co.)

C-1 Century Electric Co..... 12
906 So. Hope St., Los Angeles; 56 Natoma St., San Francisco; 65 Front St., Portland, Ore.

C-3 Crocker-Wheeler Co..... 3
Crossley Bldg., 618 Mission St., San Francisco; 228 Central Avenue, Los Angeles.

C-4 Cutler-Hammer Manufacturing Co..... 579 Howard St., San Francisco; Morgan Bldg., Portland, Ore.; San Fernando Bldg., Los Angeles.

D-4 Davis Slate & Manufacturing Co..... Chicago, Ill.

D-2 Dearborn Drug and Chemical Works..... 11
355 East Second St., Los Angeles; 301 Front St., San Francisco.

E-7 Economy Fuse & Mfg. Co..... Kinzie and Orleans Sts., Chicago.

E-1 Edison Lamp Works of General Electric Co..... Rialto Bldg., San Francisco; 724 So. Spring St., Los Angeles.

E-2 Edison Storage Battery Supply Co..... 2
441 Golden Gate Ave., San Francisco.

E-3 Electric Agencies Co..... 247 Minna Street, San Francisco; Central Building, Los Angeles.

E-6 Electric Novelty Works..... 533 Mission St., San Francisco.

E-4 Electric Storage Battery Co..... 743 Rialto Bldg., San Francisco.

E-5 Electric, Railway & Manufacturing Supply Co..... 11
34 Second St., San Francisco.

F-1 Fairbanks, Morse & Co..... Los Angeles; Portland; 651 Mission St., San Francisco; Seattle; Spokane.

F-3 Federal Sign System (Electric)..... 5
618 Mission St., San Francisco.

G-1 General Electric Co..... 10
724 So. Spring St., Los Angeles; Worcester Bldg., Portland; Rialto Bldg., San Francisco; Colman Bldg., Seattle; Paulsen Bldg., Spokane.

G-1 General Vehicle Co..... 1117 Van Ness Ave., San Francisco; 331 Wall St., Los Angeles; British Columbia Electric Ry., Ltd., Vancouver, B. C.

H-1 Habirshaw Wire Co..... (See Western Electric Company.)

H-2 Hemingray Glass Co..... 2
236-240 So. Los Angeles St., Los Angeles; 345 Oak St., Portland; 807 Mission St., San Francisco.

H-3 Haller-Cunningham Electric Co..... 428 Market St., San Francisco.

H-5 Hunt, Mirk & Co..... 141 Second St., San Francisco.

H-7 Hurley Machine Co..... New York and Chicago. (See Pacific States Electric Co.

I-2 Illinois Electric Co..... 261-263 So. Los Angeles St., Los Angeles.

I-3 Interstate Electric Novelty Co..... 3
111 New Montgomery St., San Francisco.

L-1 Leahy Manufacturing Co..... Eighth and Alameda St., Los Angeles.

L-2 Locke Insulator Manufacturing Co..... 4
(See Pierson, Roeding & Co.)

M-2 McGlauflin Manufacturing Co..... Sunnyvale, Cal.

M-4 Morse Chain Company..... Monadnock Bldg., San Francisco.

M-3 Moore & Co., Charles C..... 3
Van Nuys Bldg., Los Angeles; Spalding Bldg., Portland; Kearns Bldg., Salt Lake City; Sheldon Bldg., San Francisco; Mutual Life Bldg., Seattle; Santa Rita Hotel Bldg., Tucson.

N-1 Nason & Co., R. N..... 151 Potrero Ave., San Francisco.

N-6 National Carbon Company..... Cleveland, Ohio.

N-2 National Conduit & Cable Co., The..... Trust and Savings Bldg., Los Angeles; Rialto Bldg., San Francisco.

N-3 National Lamp Works of G. E. Co..... (All Jobbers.)

N-4 New York Insulated Wire Co..... 629 Howard St., San Francisco.

N-5 Northwestern Pacific Railroad..... 808 Phelan Bldg., San Francisco.

O-1 Okonite Co. (The)..... 12
(All Jobbers.)

P-1 Pacific Electric Manufacturing Co..... 80 Tehama St., San Francisco.

P-2 Pacific States Electric Co..... 2
236-240 So. Los Angeles St., Los Angeles; 61-67 Fifth St. No., Portland; 200-210 Twelfth St., Oakland; 575 Mission St., San Francisco; 307 First Ave. So., Seattle.

P-4 Pelton Water Wheel Co..... 2
2219 Harrison St., San Francisco.

P-5 Pierson, Roeding & Co..... 4
Pacific Electric Bldg., Los Angeles; Rialto Bldg., San Francisco; Colman Bldg., Seattle.

P-6 Pittsburgh Electric Specialties Company..... 202 Aronson Bldg., San Francisco.

P-7 Pittsburgh Piping & Equipment Co..... 12
Monadnock Bldg., San Francisco.

S-1 Schaw-Batcher Company, Pipe Works, The..... 2
211 J St., Sacramento; 356 Market St., San Francisco.

S-4 Southern Pacific Co..... 4
Flood Bldg., San Francisco.

S-5 Sprague Electric Works..... 3
Rialto Bldg., San Francisco; Colman Bldg., Seattle; Corporation Bldg., Los Angeles; Electric Bldg., Portland; Paulsen Bldg., Spokane.

S-6 Standard Underground Cable Co..... First National Bank Bldg., San Francisco; Hibernian Bldg., Los Angeles; Yeon Bldg., Portland; Central Bldg., Seattle, Wash.

T-1 Thomas & Co., R..... 12
Pacific States Electric Co. and Western Electric Co., Pacific Coast Representatives.

T-2 Tubular Woven Fabric Company..... Pawtucket, R. I.

U-1 Union Sheet Metal Works..... 575 Howard St., San Francisco.

W-1 Wagner Electric Manufacturing Company..... St. Louis, Mo.

W-2 Western Electric Co..... Eighth and Santee Sts., Los Angeles; 1900 Telegraph Ave., Oakland, Cal.; 680 Folsom St., San Francisco; 907 First Ave., Seattle; 45 North Fifth St., Portland, Ore.

W-3 Ward-Leonard Electric Co..... 4
Mt. Vernon, New York.

W-4 Westinghouse Electric and Manufacturing Co..... 6
50-52 East Broadway, Butte; Van Nuys Bldg., Los Angeles; Couch Bldg., Portland; 212 So. W. Temple, Salt Lake City; 165 Second St., San Francisco; Second and Cherry Sts., Seattle; Paulsen Bldg., Spokane.

W-5 Westinghouse Machine Co..... 141 Second St., San Francisco.

W-6 Westinghouse Lamp Co..... (See Westinghouse Electric & Manufacturing Co.)

W-8 Western Pipe & Steel Co..... 444 Market St., San Francisco; 1758 North Broadway, Los Angeles.